

JC07 Rec'd PCT/PTO 2 2 FEB 2002

FORM PTO-1288 (REV. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER Eryurtlu -3 U.S. APPLICATION NO. (if known, see 37 CFR 1.5) <b>10/069686</b>
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			
INTERNATIONAL APPLICATION NO. PCT/GB00/01844	INTERNATIONAL FILING DATE 5/15/2000	PRIORITY DATE CLAIMED 08/31/1999	
TITLE OF INVENTION Video Signal Error Detection Systems			
APPLICANT(S) FOR DO/EO/US Eryurtlu, F.M.			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<p>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371</p> <p>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p>a. <input type="checkbox"/> is attached hereto.</p> <p>b. <input checked="" type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input checked="" type="checkbox"/> have been communicated by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p>Items 11 to 20 below concern document(s) or information included:</p> <p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included</p> <p>13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment.</p> <p>14. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</p> <p>15. <input type="checkbox"/> A substitute specification.</p> <p>16. <input type="checkbox"/> A change of power of attorney and/or address letter</p> <p>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825</p> <p>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</p> <p>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4)</p> <p>20. <input type="checkbox"/> Other items or information:</p>			

"Express Mail" mailing label	
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Date of Deposit	2/22/02
1 hereby	is being deposited
with the Un.	and Service Express Mail Post
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indicated at	of the communication of
Patents and	
Washington	
(Printed name)	F. NORTZ
(Signature)	E. NORTZ

U.S. APPLICATION NO. (37 CFR 1.53) <b>10/069686</b>	INTERNATIONAL APPLICATION NO. PCT/GB00/01844	ATTORNEY'S DOCKET NUMBER Eryurtlu-3																				
21. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> \$ 890.00		<b>CALCULATIONS PTO USE ONLY</b>																				
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)). \$																						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">CLAIMS</th> <th style="width: 20%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;">\$</th> </tr> <tr> <td>Total claims</td> <td>5 - 20 =</td> <td></td> <td>x \$18.00</td> <td>\$</td> </tr> <tr> <td>Independent claims</td> <td>1 - 3 =</td> <td></td> <td>x \$84.00</td> <td>\$</td> </tr> <tr> <td colspan="3">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td>+ \$280.00</td> <td>\$</td> </tr> </table>	CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	Total claims	5 - 20 =		x \$18.00	\$	Independent claims	1 - 3 =		x \$84.00	\$	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$	<b>TOTAL OF ABOVE CALCULATIONS =</b> \$ 890.00	
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<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27 The fees indicated above are reduced by 1/2. \$																						
<b>SUBTOTAL =</b> \$ 890.00																						
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)). \$																						
<b>TOTAL NATIONAL FEE =</b> \$ 890.00																						
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$ 40.00																						
<b>TOTAL FEES ENCLOSED =</b> \$ 930.00																						
Amount to be refunded: \$																						
charged: \$																						
a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed. b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. <u>12-2325</u> in the amount of \$ <u>930.00</u> to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>12-2325</u> . A duplicate copy of this sheet is enclosed. d. <input type="checkbox"/> Fees are to be charged to a credit card. <b>WARNING:</b> Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038																						
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.																						
SEND ALL CORRESPONDENCE TO: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">           Docket Administrator            Lucent Technologies Inc.            Room 3J-219            101 Crawford's Corner Rd.            Holmdel, NJ 07733-3030         </div> <div style="margin-top: 20px;">           SIGNATURE             _____            NAME Gregory J. Murgia            _____            41209            _____            REGISTRATION NUMBER         </div>																						

IN THE UNITED STATES  
PATENT AND TRADEMARK OFFICE

**Patent Application**

Inventor(s) Faruk Mehmet Eryurtlu  
Case 3  
Serial No. Group Art  
File Date  
Examiner  
Title VIDEO SIGNAL ERROR DETECTION SYSTEMS

ASSISTANT COMMISSIONER FOR PATENTS AND TRADEMARK  
WASHINGTON, DC 20231

Dear Sir:

**PRELIMINARY AMENDMENT**

The version of the claims showing the changes made to the claims of the application are attached for your review.

**In The Claims:**

Please replace claim 3 as follows:

3. ( amended) A system according to Claim 1, wherein the first comparator acts as a mode decision circuit capable of generating one of three outcomes namely, inter-frame prediction, no inter-frame prediction and unknown.

**REMARKS**

By way of the Preliminary Amendment, Applicant has amended claim 3 in the above-identified application in accordance with typical U.S. patent practice. In the event of any fees inadvertently omitted or any improper payment of fees, the Commissioner is hereby authorized to charge or credit Lucent Technologies Deposit Account No.12-2325

to correct the error now or during the pendency of this application, except for the issue fee.

If the Examiner has any questions or feels that a telephone conversation would be helpful, please contact Julio Garceran at (973) 386-2286.

Respectfully submitted,  
Faruk Mehmet Eryurtlu

By:   
Julio A. Garceran, Attorney  
Reg. No. 37,138

Lucent Technologies Inc.

Date: 1/3/02

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PCT/GB00/01844

- 1 -

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VIDEO SIGNAL ERROR DETECTION SYSTEMS

The present invention relates to video signal error detection systems.

5 Mobile phones now have the facility to transmit and receive video signals so that the communicating parties can view each other while speaking.

Because of restricted bandwidths, the signals are transmitted at low bit rates. Because mobile phone networks are now so extensive and the transmission medium is air,  
10 the transmitted signals are more susceptible to corruption, for example, due to channel errors. Accordingly, there is a need to check received video signals for errors.

The video signals are usually transmitted in a succession of successive macroblocks. Each macroblock may comprise a block of 16 x 16 pixels of a picture frame. A simple  
15 error check may be carried out in the mobile phone receiving the signal, by counting the coefficients in the macroblock. In a 16 x 16 macroblock there will be a maximum of 256 coefficients and, if more are counted, it can be assumed that an error has occurred. In this event, the macroblock being received may be suppressed and replaced by the corresponding block in the previous frame or other error concealment techniques may be used.

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However, other errors may not be so easy to detect.

It is an object of the invention to provide an improved video signal error detection

system.

According to the present invention there is provided a video signal error detection system for use in a receiver having a decoder for receiving encoded video signals produced by an encoder in a transmitter, the encoder being selectively operative to transmit only differences between selected macroblocks in successive frames when a specific difference criteria between said successive blocks is not exceeded, the detection system comprising a first comparator for comparing macroblocks in successive frames in the output signal from said decoder, applying said specific difference criteria to provide an indication of whether inter-frame prediction should apply or not, and a second comparator for comparing the output from the first comparator with an output from the decoder indicative of whether or not the last macroblock received was in inter-frame prediction format or not and operable to generate an error signal when a divergence is detected.

The video signal error detection system embodying the present invention, will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a block diagram of a video transmission system; and

Figure 2 is a block diagram of a video reception system.

The video transmission system shown in Figure 1 comprises a video camera 2 which generates a video output signal representative of a picture frame.

The output of the camera 2 is fed to an encoder 8. The output of the encoder 8 is fed via a delay circuit 4 to a buffer memory 6 and directly to a transmitter 10 which transmits the signal via an antenna 12 to a remote station. The encoder 8 compares the current picture frame signals being received from the camera 2 with the immediately preceding picture frame signals as stored in the buffer memory 6.

The encoder 8 exploits the correlation between successive frames. The current video coding standards use block matching motion compensation technique for inter-frame prediction. In this approach, if the current picture block is similar to another block in the previous frame (picture) within the search area, the displacement (motion) vector and the difference between those two blocks are encoded (INTER mode). Otherwise, the current picture is encoded without any inter-frame prediction (INTRA mode).

Each block, hereinafter called a macroblock, may comprise a 16 x 16 pixel block.

The video reception system, shown in Figure 2, includes an antenna 14 which feeds a receiver 16. The output of the receiver 16 is fed to a decoder 18. The decoder 18 decodes the bit stream which also includes a mode indicator signal from the receiver. This mode information is fed to a mode decision circuit 24. The reconstructed picture is fed to an error concealment circuit 28, and also to a buffer 22 so that the buffer 22 is always updated to provide the previous (the immediately preceding) picture frame.

The output of the error concealment circuit 28 is displayed on a visual display unit



(VDU) 20.

The mode decision circuit 24 responds to the output of the decoder 18 and the buffer 22 to carry out a similar decision making process to that carried out in the encoder 8 ie it tries to predict whether the two macroblocks being compared qualify for INTER or INTRA mode treatment. A comparison circuit 26 then compares the output of the decision circuit with the mode indicator from the decoder 18. If concordance is not detected, there is a strong possibility of error. The error concealment circuit 28 tries to recover corrupted data if an error indication is signalled from the comparison circuit 26, using established techniques.

The mode decision circuit 24 may be constructed in a manner similar to the video codec test model Version 8 (TMN8) described by Thomas R Gardos in the proceedings of the video coding experts group question 15 (Q15-A-59) Portland 24-27 June 1997, which material is incorporated herein by reference.

In TMN8, the following parameters are calculated to make the INTRA/INTER decision:

$$MB\_mean = \left( \sum_{i=1, j=1}^{16, 16} original(i, j) \right) / 256$$

$$A = \sum_{i=1, j=1}^{16, 16} |original(i, j) - MB\_mean|$$

- 5 -

INTRA mode is chosen if  $A < B$ 

Where,

$$B = \sum_{i=1, j=1}^{16, 16} |original(i, j) - previous(i, j)| \cdot \beta$$

$$\beta = \{600 \text{ } mv = 0$$

$$\{500 \text{ } mv \neq 0$$

10

The parameter *previous* (*i,j*) corresponds to the best match block in the previous frame used for motion compensation, and *mv* is the motion vector.

Since the decoder does not have the original values, the term "original" has to be replaced by the term "reconstructed". The change from two-outcome to three-outcome case is achieved by considering an error margin E due to the problems discussed above:

INTRA mode if  $A < B - E$ UNKNOWN if  $B - E < A < B + E$ 

20

INTER mode if  $B + E < A$ 

A mode change from INTER to INTRA (or vice versa) indicates that the current block is corrupted, and therefore appropriate error concealment techniques should be used,

such as the one hereinbefore described.

Obviously, the value of  $E$  should be tuned depending on the system in use. It is a trade-off between the accuracy and rate of detection of the corruption blocks. If the decoder and encoder both employ the same method for mode selection, then a smaller  $E$  can be selected.

The difference between the original and decoded pixel values depending on the quantization parameter  $q$ . Therefore,  $E$  should be a function of  $q$ . This function should be determined by considering the quantizer. For the TMN8 quantizer,  $E$  value is defined as follows:

$$E = \begin{cases} 256 & \text{if } q < 4 \\ 64q & \text{if } q \geq 4 \end{cases}$$

CLAIMS

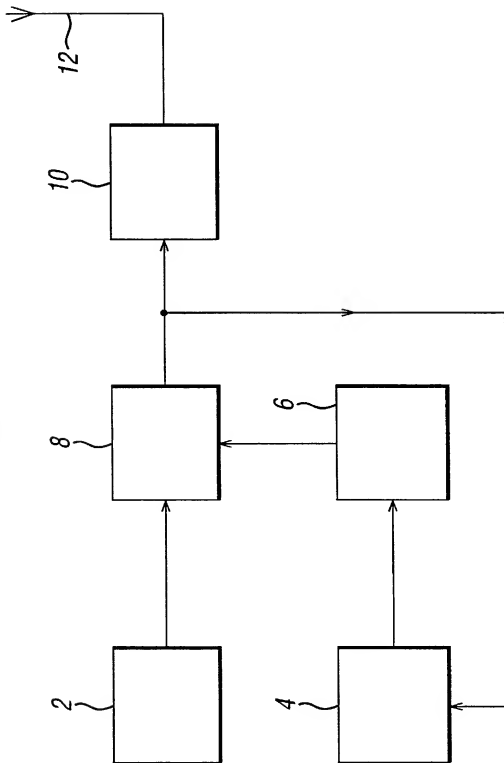
1. A video signal error detection system for use in a receiver having a decoder for receiving encoded video signals produced by an encoder in a transmitter, the encoder being  
5 selectively operative to transmit only differences between selected macroblocks in successive frames when a specific difference criteria between said successive blocks is not exceeded, the detection system comprising a first comparator for comparing macroblocks in successive frames in the output signal from said decoder, applying said specific difference criteria to provide an indication of whether inter-frame prediction should apply or not, and  
10 a second comparator for comparing the output from the first comparator with an output from the decoder indicative of whether or not the last macroblock received was in inter-frame prediction format or not and operable to generate an error signal when a divergence is detected.
- 15 2. A system according to Claim 1, including an error concealment circuit responsive to the output of the decoder and buffer to recover corrupted data when the second comparator indicates an error.
3. A system according to Claim 1 or to Claim 2, wherein the first comparator acts as a  
20 mode decision circuit capable of generating one of three outcomes namely, inter-frame prediction, no inter-frame prediction and unknown.
4. A system according to Claim 3, wherein the mode decision circuit responds to each

- 8 -

macroblock of each frame from the output from the decoder to determine a mean value for the pixels and responds to the difference A between the reconstructed values of the pixels in said macroblock and the said mean value, the difference B between the reconstructed values of the pixels of the present macroblock and the reconstructed values of the pixels of the corresponding macroblock of the immediately preceding frame and the error margin E to provide a first outcome if  $A < B - E$  a second outcome if  $B - E < A < B + E$  and a third outcome if  $B + E < A$ .

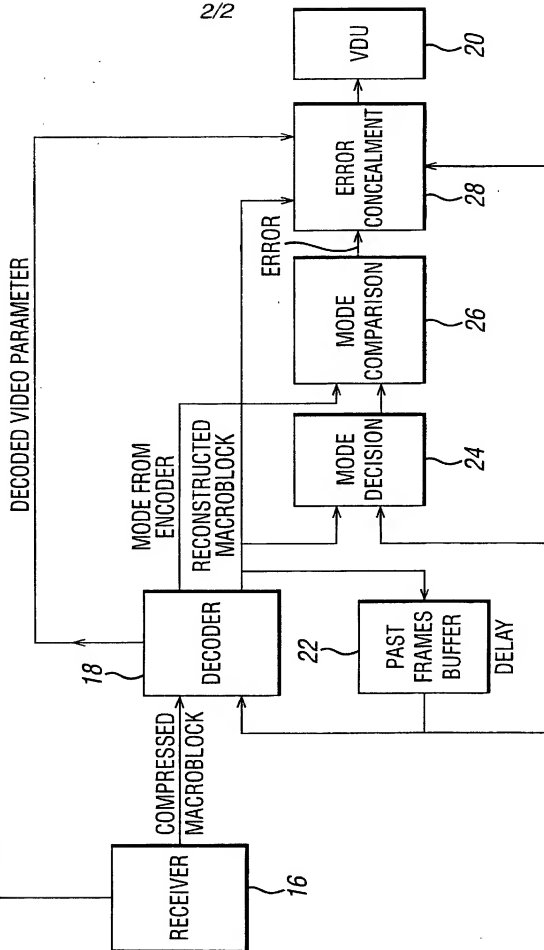
5. A system according to Claim 2, wherein the error concealment circuit acts to
- 10 replace each corrupted macroblock with a corresponding macroblock in the immediately preceding frame.

FIG. 1



2/2

FIG. 2



F.M. Eryurtlu 3

IN THE UNITED STATES  
PATENT AND TRADEMARK OFFICE

Declaration and Power of Attorney

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **Video Signal Error Detection Systems**

☒ is attached hereto

OR

☐ was filed on \_\_\_\_\_ and granted Application Serial Number \_\_\_\_\_.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

**European Application No.99306911.1 filed August 31, 1999**

I hereby claim the benefit under Title 35, United States Code, 120 of any foreign application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

**International  
Patent Application No.**  
PCT/GB00/01844

**Filing Date**  
15<sup>TH</sup> May 2000

**Status**  
Pending

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



I hereby appoint the following attorney(s) with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

Kenneth M. Brown	(Reg. No. <u>37590</u> )
Donald P. Dinella	(Reg. No. <u>39961</u> )
Martin I. Finston	(Reg. No. <u>31613</u> )
Barry H. Freedman	(Reg. No. <u>26166</u> )
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Ozer M.N. Teitelbaum	(Reg. No. <u>36698</u> )
Charles L. Warren	(Reg. No. <u>27407</u> )

I hereby authorize these attorneys to insert in the above blanks the filing date and application serial no. when known.

Please address all correspondence to the Docket Administrator (Rm. 3J-219), Lucent Technologies Inc., 101 Crawfords Corner Road, Holmdel, New Jersey 07733-3030. Telephone calls should be made to Christopher Buckley by dialing 011-44-208-504-2824.

Full name of sole inventor: Faruk Mehmet Omer Eryurtlu

Inventor's signature *F. Eryurtlu* Date 3<sup>rd</sup> September 2001

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